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L7: Entry 6 of 11 File: USPT Aug 30, 1988

DOCUMENT-IDENTIFIER: US 4767910 A
**** See image for Certificate of Correction ****
TITLE: Rapid robotic assembly change system

Detailed Description Text (27):
The number of probe elements may vary. Any number of probes may be involved dependent upon the number of welding patterns to be controlled. The probe elements operate selected ones of a plurality of proximity switches to cause signals to be generated to identify the particular fixture involved. The fixture in effect identifies the assembly to be welded and controls signals which subsequently are used to control the welding means and weld pattern generated.

Detailed Description Text (34):
The "Rapid Robotic Assembly Change-over" work-cell of the present invention has been designed and successfully used with the latest State-of-the-Art devices. A Cincinnati Milacron T3-776 electric D.C. Servo drive robot with Acramatic control and a 50 KVA trans-gun for resistance spot welding used in one embodiment of the invention. A four position rotary index tooling table with magnetically attached tooling fixtures was also used. A computer made by "Computer Technology Corporation" was used which includes an intelligent panel assembly with a CRT display module. keypad entry module and a 32 button illuminated push button module that functions as an interactive control console between the operator and the work-cell area. A Medar programmable weld controller was provided that can have as many as 15 separate weld schedules stored in memory that can be called up whenever the robot program calls for a weld. An Allen-Bradley PLC-2/05 Mini Programmable Controller coordinated the actions of the entire system to a degree determined by the mode selected by the system operator or maintenance personnel. It is apparent, however, that other types of equipment may be used without departing from the scope of the present invention.

Detailed Description Text (43):
4. The programmable controller will signal the robot to execute the proper program to weld the piece in the 180 degree work station.

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Search Results - Record(s) -39 through 10 of 11 returned.

☐ 1. 20040051059. 17 Sep 02. 18 Mar 04. Web velocity-based registration control system. Ungpiyakul, Tanakon, et al. 250/559.29; G01N021/86.

☐ 2. 20030205150. 01 May 03. 06 Nov 03. Motor driven link press. Nagae, Masayuki. 100/280; B30B001/10 B30B001/40.

☐ 3. 20030029218. 10 Jul 02. 13 Feb 03. Punch press. Nakagawa, Atsushi. 72/421; B21D043/02.

☐ 4. 20020099455. 09 Nov 01. 25 Jul 02. Programmable controller. Ward, Derek. 700/83; 700/86 716/1 G06F017/50 G05B015/00.

☐ 5. 6675628. 10 Jul 02; 13 Jan 04. Punch press. Nakagawa; Atsushi. 72/421; 100/216 100/48 72/20.1 72/20.3. B21D043/02.

☐ 6. 4767910. 30 Dec 86; 30 Aug 88. Rapid robotic assembly change system. Stevens, Jr.; Raymond R., et al. 219/125.1; 219/159 901/42. B23K009/12.

☐ 7. 4504126. 04 Oct 83; 12 Mar 85. Digital plate maker system and method. Thomas; E. Raymond, et al. 359/206; 359/214 359/650 359/783. G02B009/34.

☐ 8. 4408868. 11 Apr 80; 11 Oct 83. Digital plate maker system and method. Thomas; E. Raymond, et al. 355/77; 347/132 358/300. G03G015/00.

☐ 9. JP02000315106A. 06 May 99. 14 Nov 00. PROGRAMMABLE CONTROLLER. HASHIMOTO, YOICHI. G05B019/416; G05B019/02.

☐ 10. EP001182524A1. 24 Apr 00. 27 Feb 02. PROGRAMMABLE CONTROLLER. HASHIMOTO, YOUICHI. G05B019/02; G05B019/416 G05D013/62.

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Terms	Documents
L6 and (programmable adj controller)	11

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☐ 1. 20040051059. 17 Sep 02. 18 Mar 04. Web velocity-based registration control system. Ungpiyakul, Tanakon, et al. 250/559.29; G01N021/86.

☐ 2. 20030205150. 01 May 03. 06 Nov 03. Motor driven link press. Nagae, Masayuki. 100/280; B30B001/10 B30B001/40.

☐ 3. 20030029218. 10 Jul 02. 13 Feb 03. Punch press. Nakagawa, Atsushi. 72/421; B21D043/02.

☐ 4. 20020099455. 09 Nov 01. 25 Jul 02. Programmable controller. Ward, Derek. 700/83; 700/86 716/1 G06F017/50 G05B015/00.

☐ 5. 6675628. 10 Jul 02; 13 Jan 04. Punch press. Nakagawa; Atsushi. 72/421; 100/216 100/48 72/20.1 72/20.3. B21D043/02.

☐ 6. 4767910. 30 Dec 86; 30 Aug 88. Rapid robotic assembly change system. Stevens, Jr.; Raymond R., et al. 219/125.1; 219/159 901/42. B23K009/12.

☐ 7. 4504126. 04 Oct 83; 12 Mar 85. Digital plate maker system and method. Thomas; E. Raymond, et al. 359/206; 359/214 359/650 359/783. G02B009/34.

☐ 8. 4408868. 11 Apr 80; 11 Oct 83. Digital plate maker system and method. Thomas; E. Raymond, et al. 355/77; 347/132 358/300. G03G015/00.

☐ 9. JP02000315106A. 06 May 99. 14 Nov 00. PROGRAMMABLE CONTROLLER. HASHIMOTO, YOICHI. G05B019/416; G05B019/02.

☐ 10. EP001182524A1. 24 Apr 00. 27 Feb 02. PROGRAMMABLE CONTROLLER. HASHIMOTO, YOUICHI. G05B019/02; G05B019/416 G05D013/62.

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Terms	Documents
L6 and (programmable adj controller)	11

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L10: Entry 6 of 37 File: USPT Jan 10, 1995

DOCUMENT-IDENTIFIER: US 5380181 A
**** See image for Certificate of Correction ****
TITLE: Control device for an electric injection molding machine

Abstract Text (1):
A control device for an electric injection molding machine designed to advance and retract a screw in a heating cylinder by an injection motor includes a screw position detector for detecting a screw position to output a screw position detection signal, a speed pattern generator for generating a speed setting pattern signal which indicates relationship between time and screw speed. An integration unit integrates the speed setting pattern signal to obtain a moving stroke of the screw. And a generation unit generates a position instruction signal on the basis of the moving stroke and a screw position when injection is initiated. To generate a speed instruction signal, the screw position detection signal is subtracted from the position instruction signal as a manipulated variable of feedback and the speed setting pattern signal is applied to the position instruction signal as a manipulated variable of feed forward. Thus, accuracy at the speed changing positions can be improved, thus improving operability.

Brief Summary Text (9):
To detect screw position, a screw position detector 23 is mounted between the support member 14 and the frame. An amplifier 24 amplifies the screw position detection signal of the screw position detector 23, and inputs the resultant signal to the controller 22. The controller 22 outputs a speed instruction signal determined for every process on the basis of the operator's setting value input to a servo amplifier 25 to drive the injection motor 11.

Brief Summary Text (13):
In FIG. 2, when the operator inputs changing positions and injection speeds to a position pattern generator 28 of the controller 22 from a setting unit, the position pattern generator 28 performs calculation on the basis of the set values, and generates a position setting pattern signal a. The position setting pattern signal a is generated on the basis of the relation between the changing positions and the screw speeds desired by the operator, and consists of a time signal and a screw position instruction signal.

Brief Summary Text (14):
The position setting pattern signal a is output to a subtracter 29 to which an actual screw position detection signal d is fed back from the amplifier 24. The subtracter 29 outputs a position deviation signal b to a compensator 30. The compensator 30 performs a compensation operation, and outputs a speed instruction signal c to the servo amplifier 25. In this way, the screw speed is controlled by feeding back the screw position.

Brief Summary Text (35):
The resultant signal of the compensator 63 is output to a servo amplifier 64 as a speed instruction signal h. The servo amplifier 64 controls armature current j of the injection motor 11 such that the speed instruction signal h equals rotational speed detection signal i detected by the speed detector 45.

Brief Summary Text (45):
To achieve the above object, the present invention provides a control device for an electric injection molding machine designed to advance and retract a screw in a heating cylinder by an injection motor, which comprises a screw position detector for detecting a screw position to output a screw position detection signal, and a speed pattern generator for generating a speed setting pattern signal which indicates a relation between a point in time and speed.

Brief Summary Text (50):
The present invention further provides a control device for an electric injection molding machine designed to advance and retract a screw in a heating cylinder by an injection motor, which comprises pressure detection means for detecting a reaction force received by the screw to generate a pressure detection signal, a pressure pattern generator for generating a pressure instruction signal having a first order lag waveform upon receipt of a pressure setting signal having a stepped waveform, and means for subtracting the pressure detection signal from the pressure instruction signal as a manipulated variable of feedback to generate a speed instruction signal.

Detailed Description Text (7):
Reference numeral 52 denotes a hopper for accommodating resin pellets, reference numeral 54 denotes a heating cylinder, reference numeral 58 denotes an injection nozzle through which the resin is injected, reference numeral 65 denotes a controller and reference numeral 66 denotes a servo amplifier.

Detailed Description Text (17):
When screw position is detected by the screw position detector 23, a resultant screw position detection signal is input to the CPU 80 through the screw position input interface 86. When the rotational speed of the injection motor 11 is detected by the speed detector 45, a resultant speed detection signal is input to the servo amplifier 66. When a dwell pressure is detected by the load cell 18, a resultant pressure detection signal is input to the CPU 80 through the A/D converter 88.

Detailed Description Text (18):
In FIG. 8, reference numeral 24 denotes an amplifier for amplifying a screw position detection signal from the screw position detector 23 (FIG. 6), reference numeral 65 denotes the controller; and reference numeral 66 denotes the servo amplifier.

Detailed Description Text (19):
When the operator sets the changing position and the screw speed from the input unit for setting 81 (FIG. 7) connected to the controller 65, a speed pattern generator 68 generates a speed setting pattern signal k on the basis of the set values. In that case, the speed setting pattern signal k is generated on the basis of the relation between the time and the screw speed, and is output as a screw speed signal at predetermined time intervals after the injection process has been initiated. The speed setting pattern signal k is input to an integrator 69 serving as integration means. The integrator 69 performs integration on the signal k, and outputs a moving stroke signal m. Since the moving stroke signal m is an integral of the speed setting pattern signal k, it represents the screw position at a specific point, i.e., the moving stroke of the screw 20 from the injection starting position. When the start of the injection process is recognized, a sequence processing device (not shown) in the controller 65 outputs an injection starting signal n to a screw position storing device 71. When the screw position storing device 71 receives the injection starting signal n when the injection process is initiated, it stores a screw position detection signal d, holds it throughout the injection process and outputs it, as an initial screw position signal p, to an adder 72.

Detailed Description Text (20):

The adder 72 adds the initial screw position signal to the moving stroke signal m. Since the initial screw position signal p represents the screw position when the injection process is initiated while the moving stroke signal m represents the stroke distance from the initial screw position which varies with time, a position instruction signal q is obtained as the result of the addition of the adder 72. The position instruction signal q corresponds to the position setting pattern signal a output from the position pattern generator 28 (see FIG. 2) in the control device of a conventional electric injection molding machine.

Detailed Description Text (21):
The position instruction signal q is output to a subtracter 73 to which the screw position detection signal d is fed back. The subtracter 73 outputs the position deviation signal b. The compensator 30 performs the compensation operation on the position deviation signal b, and generates a signal u, a manipulated variable in a position control system to the servo amplifier 66.

Detailed Description Text (22):
The speed setting pattern signal k is likewise input to a compensator 72. The compensator 72 performs compensation on the signal k, and generates a signal g. An adder 75 adds the signal g to the signal u, and generates a speed instruction signal c fed to the servo amplifier 66.

Detailed Description Text (23):
In that case, changing of the speed without a delay is accomplished by inputting the speed instruction signal c to the servo amplifier 66. In a control operation which employs only the signal g, as the time elapses, a deviation occurs between the actual value and the set value in terms of the time, screw position or screw speed due to a disturbance, such as an error at the gain zero point on a circuit or the reaction applied by the resin to the screw 20. In this invention, switch-over of the speed without a delay is achieved by correcting the signal g using the signal u, thus achieving highly accurate speed control.

Detailed Description Text (26):
In FIG. 9, reference numeral 11 denotes an injection motor, and reference numeral 18 denotes a load cell for detecting dwell pressure after filling has been completed. The dwell pressure detected by the load cell 18 is fed back to a subtracter 91 as a pressure detection signal e. The subtracter 91 subtracts the pressure detection signal e from a pressure instruction signal r output from a pressure pattern generator 92, and outputs a pressure deviation signal s to a compensator 93.

Detailed Description Text (27):
The resultant signal of the compensator 93 is output to a servo amplifier 66 as a speed instruction signal h. The servo amplifier 66 controls armature current j of the injection motor 11 such that the speed instruction signal h equals to a rotational speed detection signal i detected by the speed detector 45.

Detailed Description Text (29):
The pressure instruction signal r is generated by the pressure pattern generator 92 to which a pressure setting signal f is input.

Detailed Description Text (30):
The pressure pattern generator 92 has the function of a filter, and generates a first order lag signal waveform by deforming the pressure setting signal waveform which has been set stepwise by a pressure program, such as a dwell pressure setting program or a back pressure setting program.

Detailed Description Text (33):
Whereas the pressure setting signal f is set stepwise by the pressure program, the pressure instruction signal r output from the pressure pattern generator 92 (FIG.

9) has a waveform of first order lag.

CLAIMS:

1. A control device for an electric injection molding machine designed to advance and retract a screw in a heating cylinder by an injection motor, said control device comprising:

(a) a screw position detector for detecting a screw position to output a screw position detection signal;

(b) a speed pattern generator for generating a speed setting pattern signal which indicates a relation between a time and a screw speed;

(c) integration means for integrating the speed setting pattern signal to obtain a stroke of said screw;

(d) generation means for generating a position instruction signal on the basis of the stroke and the screw position when injection is initiated;

(e) means for subtracting the screw position detection signal from the position instruction signal, as a manipulated variable of feedback, to generate a position deviation signal; and

(f) means for adding the speed setting pattern signal to the position deviation signal, as a manipulated variable of feed forward, and for generating a speed instruction signal.

4. A control device for an electric injection molding machine designed to advance and retract a screw in a heating cylinder by an injection motor, said control device comprising:

(a) pressure detection means for detecting a reaction force on the screw to generate a pressure detection signal;

(b) a pressure pattern generator for generating a pressure instruction signal, having a first order lag waveform, upon receipt of a pressure setting signal having a stepped waveform; and

(c) means for subtracting the pressure detection signal from the pressure instruction signal, as a manipulated variable of feedback, to generate a pressure deviation signal.

L10: Entry 9 of 37 File: USPT Oct 6, 1987

DOCUMENT-IDENTIFIER: US 4698509 A
TITLE: High speed pattern generator for electron beam lithography

Abstract Text (1):
A pattern generator for supplying beam deflection and blanking signals in an electron beam lithography system which writes polygon pattern features by sweeping a beam of rectangular cross-section over each polygon and simultaneously varying the length of the rectangular cross-section. The pattern generator converts polygon size and shape data to an upper shape signal and a lower shape signal. The shaping signals are subtracted to provide a beam length signal. The lower shape signal controls the beam position during writing of the polygon. The pattern generator further includes a ramp generator for sweeping the beam over the polygon. The ramp signal and shaping signals are synchronized by detecting the points in the sweep at which polygon turn points occur. The shape signal generators utilize interleaved operation for high speed. A blanking circuit provides uniform exposure of pattern features by controlling the width of the rectangular beam. The beam is ramped on and off at a rate which matches the rate of the sweep signal.

Brief Summary Text (2):
This invention relates to control apparatus for electron beam lithography systems and, more particularly, to control apparatus for high speed pattern generation in a system utilizing variable length line scanning.

Drawing Description Text (7):
FIG. 5 is a block diagram of the pattern generator of FIG. 1;

Detailed Description Text (6):
The above description relates to the exposure of a single pattern feature. The exposure of a complete level of a semiconductor wafer or of a mask plate requires exposure of many thousands of such features in an accurate and high speed manner. Data representing pattern features must be converted to signals for controlling the electron beam column. In addition, the movable stage must position the area of the workpiece being exposed within the deflection field of the electron beam. Referring again to FIG. 1, the operation of the system is under control of a supervisor computer 80. Pattern data in a format compatible with high speed writing is stored on a pattern disc 82. Data representing each individual pattern feature to be written on the workpiece includes an x, y location of the feature and a complete description of the pattern feature, as described in more detail hereinafter When a workpiece is to be exposed, the appropriate set of pattern data is transferred by the supervisor computer 80 from the pattern disc 82 to a high speed pattern memory 84. The pattern data is transferred serially from the pattern memory 84, one pattern feature at a time, to a pattern generator 86. Pattern generator 86, under the direction of a write controller 88, converts the pattern data to analog signals for controlling the electron beam column 10. The signals generated by the pattern generator 86 are converted to the appropriate voltage and current levels by a beam shaping and deflection amplifier unit 90 located in close proximity to the electron optical column 10. The pattern generator 86 receives control signals from the write controller 88 and stage error signals from a stage controller 92. The stage controller 92 controls the x, y position of the stage 20 through a servo amplifier unit 94 and monitors the actual position of the stage 20 through a highly accurate

laser interferometer system 96. Errors between required position and actual position are supplied to the pattern generator 86. The write controller 88 also controls electron optical column 10 parameters, which remain stationary during writing, through a column controller 97. The column controller 97 controls components of the column 10 such as the electron source, centering coils and lenses. The base assembly 12 includes a substrate handler 99 which exchanges workpieces after completion of processing. The substrate handler 99 is controlled by the supervisor computer 80 through a substrate controller 98.

Detailed Description Text (7):
A block diagram of the pattern generator 86 is shown in FIG. 5. The analog signal outputs for a vertical line swept horizontally are as follows. The LINE LENGTH signal energizes the y-axis shaping deflector 38y to control the length of the shaped electron beam, as shown in FIGS. 3A and 3B. The LINE POSITION signal controls the y-axis correcting deflector 48y to move the y-position of the lower end of the electron beam, as shown in FIGS. 3D, 4A and 4C. A BLANKING signal (FIG. 4E) controls the x-axis shaping deflector 38x to accomplish beam blanking, as shown in FIG. 3C. The beam is unblanked during writing of pattern features and is blanked during the time when the beam is being shifted to the location of a new pattern feature. The beam can be increased gradually in width at the beginning and end of pattern features to improve exposure uniformity by utilizing a ramped BLANKING signal. A BLANKING CORRECTION signal is applied to the x-axis correcting deflector 48x to provide a second order correction during the ramped-on and ramped-off BLANKING signal. An X-DEFLECTION signal applied to the x-axis deflection coils 50 positions the beam at the initial x-axis location of the pattern feature and then sweeps the line beam across the pattern feature at a prescribed sweep rate. A Y-DEFLECTION signal applied to the y-axis deflection coils 50 positions the beam at the y-axis location on the workpiece of the pattern feature.

Detailed Description Text (12):
The pattern generator 86, for converting pattern data into analog signals for energizing the electron beam column 10, is shown in FIG. 5. The pattern data is supplied serially, one byte at a time, to an upper segment processor 110 and to a lower segment processor 112. In addition, a control bus from the write controller 88 supplies set-up and control signals, such as scan speed, beam width, etc., to various parts of the pattern generator 86. The control bus is generally inactive during exposure of polygons. The segment processors 110, 112 convert the pattern data to the form required by the analog circuitry. In addition, the segment processors 110, 112 act as data rate buffers between the pattern data stream and the analog signals. The pattern data is supplied in bursts from the pattern memory 84 according to a regular clock rate, while the analog signals are supplied asynchronously to the electron beam column 10 in accordance with prescribed sweep rates. The average rates of the pattern data and the analog signals must be the same to insure continuous writing. The upper segment processor 110 accepts upper segment data (data describing the upper edge of the polygon) from the pattern data stream, while the lower segment processor 112 accepts lowers segment data (data describing the lower edge of the polygon) from the pattern data stream. The upper segment processor 110 provides data including upper height (UP H), upper slope height (UP dH) and upper segment length (UP dL) to an upper shape generator 114. The lower segment processor 112 provides data including lower height (LO H), lower slope height (LO dH) and lower segment length (LO dL) to a lower shape generator 116.

Detailed Description Text (21):
The output of the FIFO 160 is controlled by a control 172, which receives control signals from the analog circuitry. Each time the writing of a segment is completed, the control 172 receives a turn point pulse, UP TURNPT or LO TURNPT, as shown in FIGS. 4G and 4I, indicating that data for the next segment is to be strobed to the FIFO 160 output. The digital circuitry in the pattern generator 86 typically utilizes emitter coupled logic (ECL) for high speed. In addition, the FIFO 160 uses

a parallel arrangement to insure high speed operation. The A and B sections of the FIFO 160 have outputs coupled to a temporary storage register 174, which contains A and B sections for each data type (dL, dH, H, L). The outputs of the register 174 are coupled to a multiplexer 176 having regions for each data type. The A and B FIFO 160 sections alternate read and write memory operations so that segment data can be supplied essentially continuously. The multiplexer 176 alternately selects segment data from the A and B sections of the register 174 so that no waiting is required for FIFO 160 read and write operations.

Detailed Description Text (22):
A block diagram of the shape generators 114, 116 is shown in FIG. 7. As noted above, the pattern generator is required to operate at very high speed to insure that writing can proceed without the necessity of waiting for data processing. A preferred embodiment of the shape generator shown in FIG. 7 includes two identical shape generator circuits referenced as A and B. These circuits are interleaved, or time-multiplexed, in operation. The A and B sections of the shape generator provide the signals for alternating segments of the polygon. For example, the A section of upper shape generator 114 supplies signals for segments x.sub.p a, bc and de, while the B section supplies signals for segments ab, cd and ef. During the periods between alternating segments, the A and B sections perform the necessary processing of data. Thus, there is no delay between segments due to data processing times or settling times.

Detailed Description Text (28):
The loading and unloading of the FIFO 240 is controlled by a FIFO control 252. The outputs of the FIFO 240 are supplied through registers 254. A POSITION READY signal from the FIFO control 252 indicates that the x, y position of a new polygon is ready. After the position has been accepted by the pattern generator circuitry, a POSITION TAKEN signal indicates that new data can be clocked to the output.

Detailed Description Text (30):
Synchronization of the TIMING RAMP with the remainder of the pattern generator circuitry is controlled by an FET reset circuit 284 which holds the integrating capacitor in the integrator 280 in a discharged state until the required time for sweeping a polygon. A POSITION READY signal from the position and array processor 120 is supplied to a ramp control 286. The POSITION READY signal indicates that the x and y position of a polygon are available at the output of the position and array processor 120. A signal for enabling the integrator 280 is supplied by the ramp control 286 through a wait circuit 288 to the FET reset 284. The wait circuit 288 introduces a variable delay to the signal which enables the integrator 280. The delay compensates for settling times in the x, y position DAC's and the main deflection coils of the electron beam column 10. The wait circuit 288 receives a delta position input which indicates the magnitude of the position change between successive polygons. Larger settling times are required for relatively large position changes. Therefore, the delay is scaled to insure that the beam is properly positioned before sweeping of the polygons begins. An END signal supplied from the blanking circuit 150 to the ramp control 286 indicates that the polygon is complete and causes the TIMING RAMP to be reset.

Detailed Description Text (39):
In operation, the pattern data file for the level of the wafer or mask being written is transferred from the pattern disc 82 to the pattern memory 84. Necessary initial parameters, such as workpiece size, pattern extent, resist type, beam width, scan speed, etc., are set up. When the system is ready to begin exposure, or writing, of the pattern, pattern data is transferred from the memory 84 to the pattern generator 86, one byte at a time. Polygon data is processed by the segment processors 110, 112 and by the position and array processor 120, as described hereinabove, and is stored in the respective FIFO's. After the data for a polygon has been completed, writing can begin. Processing of pattern data continues, and polygon data is stored in serial fashion in the segment processor FIFO's and the

position and array FIFO's. This insures that data is available for continuous writing.

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L10: Entry 15 of 37 File: USPT Sep 7, 1982

DOCUMENT-IDENTIFIER: US 4348731 A
TITLE: Automatic working apparatus and method of controlling the same

Drawing Description Text (5):
FIG. 4 is a block diagram showing a speed pattern generator according to an embodiment of the invention.

Drawing Description Text (6):
FIG. 5 is a signal wave diagram illustrating the output state of the speed pattern generator shown in FIG. 4.

Detailed Description Text (6):
In the case in which the automatic working apparatus includes at least a rotatable portion and the route-controlled object is driven through the rotatable portion, there are employed encoders, transducers, potentiometers or the like for detecting the attitude of the movable parts, i.e. the position of the route-controlled object. The output signals available from the attitude detector means are utilized for arithmetically determining the coordinates of the route-controlled object. The individual movable parts or the drive means are controlled so that the above arithmetically determined coordinates may be located on or adjacent to the straight line interconnecting the two bend points as previously taught or programmed, thereby to move the route-controlled object from one bend point to the next one. The arithmetic operation for determining the coordinates of the route-controlled object is executed in synchronism with the sampling pulses which may be preferrably produced at a predetermined periodical rate. The magnitude of the speed command for moving the route-controlled object during each sampling period is progressively decreased for the deceleration command and progressively increased for the acceleration command. It is equally possible to control the speed of the route-controlled object by progressively elongating the duration of the sampling period for the deceleration command and shortening progressively the sampling period for the deceleration command in the case in which the displacement of the route-controlled object during every sampling period is constant. The speed of the route controlled object can be controlled by the output signal from a speed pattern generator which may be constituted by an up-down counter. When the acceleration command is issued, the contents of the up-down counter is progressively increased and the counting is stopped after a predetermined time elapse. The attained count is held until the deceleration command is produced, whereupon the output from the up-down counter serving as the speed pattern generator is progressively decreased.

Detailed Description Text (10):
An exemplary embodiment of the control apparatus according to the invention is schematically shown in a block diagram in FIG. 2. In this figure, reference numeral 27 denotes a console which is provided with a power switch 28 for turning on or off the power supply to the working apparatus shown in FIG. 1, a switch 29 to start a hydraulic pump for actuating the hydraulic actuators 7 and 13 as well as the first and second swing motors 18 and 19, and mode change-over switch 30 for changing over the teaching mode and the play-back mode to each other, as illustrated in FIG. 3. A switch array for the teaching mode includes three-position change-over switches 31 and 32 for driving the first and second swing motors 18 and 19 in one direction (referred to as the plus direction as indicated by a plus sign in FIG. 1) or in the

other direction (referred to as the minus direction in the same sense) thereby to determine the positions or attitudes of these motors, three-position change-over switches 33, 34 and 35 for moving selectively a route-controlled object (concrete example of which will be described hereinafter) in the directions +X; -X; +Y; -Y and +Z; -Z, and a button switch 37 depressed when teaching points or bend points are to be written in a memory unit or storage 36, as described hereinafter. The console 27 is connected to a central control unit 38 of a computer through an interface unit 60. The central control unit 38 is operated to control the memory unit 36, an arithmetic operation control unit 42 and a servo controller 43 through bus lines 39, 40 and 41. Assuming that the switch 30 is changed over to the position Te for the teaching mode and one of the change-over switches 33 to 35, say the switch 33 is turned to the position +.theta., then the corresponding signal is supplied to the arithmetic operation logic 42 through the lines 44, 45 and 40, whereby the arithmetic operation control unit 42 executes the arithmetic operations required to move the route-controlled object in the direction +.theta. as described hereinafter. The result of the executed arithmetic operation is sent to the servo controller 43 through the line 46, as the result of which the electric motor 4 as well as the hydraulic actuators 7 and 13 are correspondingly operated to move the route-controlled object in the direction +.theta.. When the route-controlled object has attained a desired coordinate position, the change-over switch 33 is reset to a neutral position, whereupon the controlled object is caused to stop at that position. Subsequently, the write-in button 37 is depressed, whereby the output signals from the position or attitude detectors 22 to 26 are supplied to the memory unit 36 through the line 47. When the write-in operation has been completed, the button switch 37 is restored to the original position. A similar teaching process is repeated to store in the memory unit the bend points at which the moving direction of route-controlled object is to be changed. After the completion of the teaching processes, the change-over switch 30 is returned to a neutral position. For the play-back control, the change-over switch 30 is turned to the position labelled as PL. Then the data about the bend points stored in the memory unit 36 is read out and supplied to the arithmetic operation unit 42 through the line 48, whereby the arithmetic operations for moving the route-controlled object along straight line segments between the bend points are executed, the results of which are transferred to the servo controller 43 through the line 46. Consequently, the route-controlled object is caused to move from the one bend point to the next bend point as designated in the teaching process by means of the electric motor 4 and the hydraulic actuators 7 and 13 in response to the outputs of the servo controller 43.

Detailed Description Text (12):
The arithmetical operation unit 42 incorporates therein a speed pattern generator 50, as schematically shown in FIG. 4. The speed pattern generator 50 has an acceleration command signal input terminal 51, a deceleration command input terminal 52 and an output terminal 53. When the acceleration command input signal is applied to the terminal 51, the output signal E appearing at the output terminal 53 is progressively increased in a step-up manner as a function of time, as is illustrated in FIG. 5. The output signal E becomes constant at a certain value E.sub.max (saturated level) and remains at this maximum level until the deceleration command signal is applied to the associated input terminal 52. In response to the deceleration command, the output signal E decreases progressively in a step-down manner to ultimately attain the zero level. When the deceleration command signal is applied to the terminal 52 before the maximum or saturated level E.sub.max has been attained, then the output signal E begins to decrease progressively to zero without going up to the maximum level. On the other hand, upon application of the acceleration command signal to the input terminal 52 before the output signal E has decreased to zero, the output signal E starts to increase again progressively. The speed pattern generator 50 may be constituted by an up-down counter which itself is well known in the art. Concerning the time when the acceleration command and the deceleration command signals are produced, description will be made hereinafter. In FIG. 5, time t is taken along the abscissa.

Detailed Description Text (20):
In this connection, it is to be noted that the deceleration command signal is applied to the input terminal 52 of the speed pattern generator 50 when the route-controlled point P has reached the point preceding the bend point P.sub.n for the distance l.sub.dn.

Detailed Description Text (22):
The distance .DELTA.l is a length traced by the route-controlled point P during the single sampling period when the output signal from the speed pattern generator 50 is at the maximum level E.sub.max.

Detailed Description Text (23):
The following expressions (7), (8) and (9) are used for determining the distances or lengths .DELTA.x.sub.l, .DELTA.y.sub.l and .DELTA.z.sub.l for which the route-controlled object or point P moves in the directions X, Y and Z, respectively, for a single sampling period when the output E is produced from the speed pattern generator 50. ##EQU5##

Detailed Description Text (27):
At the step 56, comparison is made between the distances l.sub.1,2 and l.sub.d2 in synchronism with the sampling pulse. When it is found that l.sub.1,2 >l.sub.d2 as the result of the comparison, the acceleration command signal is applied to the input terminal 51 of the speed pattern generator 50. On the other hand, when l.sub.1,2 <l.sub.d2, then the deceleration command is applied to the input terminal 52. In the former case, i.e. l.sub.1,2 >l.sub.d2, the output signal E from the speed pattern generator increases progressively toward the saturation level E.sub.max, as described hereinbefore. When l.sub.1,2 <l.sub.d2, then the output signal E decreases toward zero in a step-down manner.

Detailed Description Text (29):
From the results of this computation and the output value E produced from the speed pattern generator, the speed components of the route-controlled point P in the directions X, Y and Z at the time when the corresponding sampling pulse is produced is arithmetically determined in accordance with the equations (7), (8) and (9) by the arithmetical operation unit 42 as follows: ##EQU8##

Detailed Description Text (30):
Further, the arithmetical operation unit 42 determines the increments .DELTA..theta..sub.l1,2, .DELTA..phi..sub.l1,2 and .DELTA..psi..sub.l1,2 to be effected at the respective sampling pulse from the above .DELTA.X.sub.l1,2, .DELTA.Y.sub.l1,2 and .DELTA.Z.sub.l1,2 in accordance with the equation (10). These increment values are then transmitted to the servo controller 43 which will then move the rotatable table 2, the first arm 6 and the second arm 12 correspondingly in response to the increments .DELTA..theta..sub.l1,2, .DELTA..phi..sub.l1,2 and .DELTA..psi..sub.l1,2.

Detailed Description Text (31):
The route-controlled point P passes by the taught point P.sub.2 at a speed determined by the output E produced from the speed pattern generator at that time point. Subsequently, at the step 55 (FIG. 7), the bend angle .delta..sub.3 at the coordinate point P.sub.3, i.e. the angle formed between the line segment interconnecting the points P.sub.2 and P.sub.3 and the segment connecting the coordinate points P.sub.3 and P.sub.4 as well as the length l.sub.3,4 of the straight line connecting the coordinate points P.sub.3 and P.sub.4 are arithmetically determined in accordance with the equations (4) and (3).

CLAIMS:

1. An automatic working apparatus comprising a route-controlled object to be

controlled in respect of a path along which said object is moved, a base portion, drive means including a plurality of actuator means provided between said route-controlled object and said base portion and capable of moving said route-controlled object sequentially to a plurality of positions in different directions, arithmetical operation control means for arithmetically determining bend angles at bend points to be traced sequentially by said route-controlled object and producing output signals for changing the moving speed of said route controlled object at the time when said route-controlled object passes by said bend point as a function of said bend angle in such manner that said moving speed of said route-controlled object is correspondingly decreased for a relatively greater value of said bend angle, said arithmetical operation control means calculating the bend angle at each bend point and amount of change for respective actuator means to move the route-controlled object to the bend point, said arithmetical operation control means producing an output signal for changing the moving speed of respective actuator means in accordance with the calculated bend angle, the moving speed being the speed at the time when the route-controlled object passes the bend angle, and servo control means for operating respective actuator means of said drive means in response to said output signals from said arithmetical operation control means.

3. An automatic working apparatus comprising a route-controlled object to be controlled in respect of a path along which said object is moved, a base portion, drive means including a plurality of actuator means provided between said base portion and said route-controlled object and capable of moving said route-controlled object sequentially to a plurality of positions in different directions, arithmetical operation control means for arithmetically determining a bend angle at a first one of bend points to be followed sequentially by said route-controlled object and producing an output signal for respective actuator means for changing the moving speed of said route-controlled object at the time when said route-controlled object passes by said first bend point in dependence on a product of said arithmetically determined bend angle and the inverse number of a distance between said first bend point and a second succeeding bend point in such manner that said moving speed of said route-controlled object is correspondingly decreased for a relatively greater value of said product, and servo control means for operating respective actuator means of said drive means in response to said output signals produced from said arithmetical operation control means.

5. An automatic working apparatus comprising a route-controlled object to be controlled in respect to a path along which said object is moved, a base portion, drive means including a plurality of actuator means provided between said route-controlled object and said base portion and capable of moving said route-controlled object sequentially to a plurality of positions in different directions, memory means for storing bend points of said path to be traced sequentially by said route-controlled object, attitude detector means for detecting attitudes of respective actuator means of said drive means, arithmetical operation control means responsive to the output signals from said attitude detector means for reading out from said memory means the stored data about the first bend point to be passed by said route-controlled object and the second bend point to be passes by said route-controlled object in succession to said first bend point thereby to arithmetically determine a bend angle at said first bend point and for producing output signals for respective actuator means to vary the speed at which said route-controlled object passes by said first bend point as a function of said arithmetically determined bend angle in such a manner that the speed of the route-controlled object is correspondingly decreased for a relatively greater value of said arithmetically determined bend angle, and servo control means for operating respective actuator means of said drive means in response to said output signals from said arithmetical operation control means.

6. An automatic working apparatus comprising a route-controlled object to be controlled in respect of a path along which said object is moved, a base portion, drive means including a plurality of actuator means provided between said route-

controlled object and said base portion and capable of moving said route-controlled object sequentially to a plurality of positions in different directions, memory means for storing bend points of said path to be traced sequentially by said route-controlled object, attitude detector means for detecting positions of respective actuator means, arithmetical control means for reading out from said memory means the stored data about a first bend point to be passed by said route-controlled object and the second bend point to be passed by said route-controlled object in succession to said first bend point thereby to arithmetically determine the shortest distance between said first and second bend points on the basis of said data read out from said memory means and the output signals from said attitude detector means and for producing output signals for respective actuator means to vary the speed at which said route-controlled object passes by said first bend point as a function of a product of said bend angle and the inverse number of said distance in such manner that said speed is correspondingly decreased for a relatively greater value of said product, and servo control means for operating respective actuator means of said drive means in response to said output signal from said arithmetical operation control means.

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L10: Entry 20 of 37 File: USPT May 22, 1979

DOCUMENT-IDENTIFIER: US 4155426 A
TITLE: Digital speed pattern generator

Abstract Text (1):
A digital speed pattern generator which may have acceleration, constant velocity, and deceleration phases, which is particularly advantageous for short runs in which the constant velocity phase is not reached, as well as for longer runs, such as required for high speed elevators. A first digital speed pattern signal is generated from a pulse train which has a constant average frequency related to maximum jerk. A second digital speed pattern signal is generated during the slow-down or deceleration phase from distance pulses responsive to movement of the elevator car. The first digital speed pattern signal is suitable for use as the effective speed pattern for motor control throughout the acceleration, constant velocity and deceleration phases of the speed pattern signal. The first digital speed pattern signal is slaved to follow the second digital speed pattern signal during a deceleration phase of the speed pattern, within the constraints applicable to the generation of the first digital speed pattern signal.

Brief Summary Text (3):
The invention relates in general to speed pattern generators for motor speed control, and more specifically to speed pattern generators in which a velocity signal is developed in digital form before any analog conversion thereof.

Brief Summary Text (6):
A speed pattern generator for a high speed elevator system, such as an elevator system having a rated speed between 500 fpm. and 1800 fpm., must also be able to handle "short runs", i.e., a run in which the elevator car does not attain rated speed, without exceeding the maximum jerk as the speed pattern changes from maximum positive acceleration to maximum negative acceleration, hereinafter referred to as deceleration. In addition to generating a speed pattern with the safety and comfort of the passengers in mind, it is also important that the speed pattern signal direct the elevator car without undue delay or sluggishness at any part of the speed pattern, in order to provide the most efficient service within the specified jerk, acceleration and velocity constraints.

Brief Summary Text (7):
The more accurate the speed pattern signal, the more efficient the elevator service, as allowances for error degrade response time. Thus, analog computation steps in the development of the speed pattern generator are to be minimized, as analog elements, such as operational amplifiers, are subject to temperature errors and drift.

Brief Summary Text (8):
Certain speed pattern generators of the prior art have taken advantage of digital precision, such as by utilizing registers and adders to perform certain digital calculations. The economic attractiveness and versatility of the microprocessor, which, with its burned-in PROMS forms a dedicated digital computer for performing the necessary logical and computational functions, makes it even more attractive to develop new and improved digital speed pattern generator concepts.

Brief Summary Text (9):
U.S. Pat. No. 3,589,474, entitled "Digital Pattern Generator For Motor Speed Control", which is assigned to the same assignee as the present application, discloses a speed pattern generator in which a digital count is developed from distance pulses generated by car movement. Bias pulses are initially added to the counter to start the car, and the counter counts the incoming distance pulses during acceleration. A non-linear D/A converter develops the speed pattern signals from the count. The count always represents the distance required to stop the car with a deceleration rate equal to the acceleration rate. Upon reaching rated speed, the counter ceases to count the distance pulses, and the speed pattern developed from the constant count is a constant value. When slow-down is initiated, the counter is decremented by the distance pulses, and the speed pattern is derived from this reducing count.

Brief Summary Text (13):
Briefly, the present invention is a new and improved digital speed pattern generator which generates a first digital speed pattern signal from a first pulse train having a constant average pulse rate. The pulse rate is selected to indicate the rate at which a predetermined acceleration increment should be added to, or subtracted from, acceleration counting means.

Brief Summary Text (15):
A second digital speed pattern signal is provided during the slow-down phase of the first digital speed pattern generator signal, with the second digital speed pattern signal being responsive to the distance of the controlled device, such as an elevator car, from the desired stopping point. Instead of substituting the second digital speed pattern for the first digital speed pattern, the first digital speed pattern is slaved to follow the second digital speed pattern signal, within predetermined limits. Thus, no switching or blending between the two speed pattern signals at a predetermined transition point is required, and the analog speed pattern signal always has the benefit of the inherent jerk, acceleration and velocity constraints applied to the generation of the first digital speed pattern signal.

Drawing Description Text (3):
FIG. 1 is a partially schematic and partially block diagram of an elevator system which may include a speed pattern generator constructed according to the teachings of the invention;

Drawing Description Text (4):
FIG. 2 is a detailed block diagram which functionally illustrates a digital speed pattern generator constructed according to the teachings of the invention;

Detailed Description Text (2):
Referring now to the drawings, and to FIG. 1 in particular, there is shown an elevator system 10 wherein an elevator car is mounted in a hatchway 13 for movement relative to a structure 14 having a plurality of landings. For purposes of example, it will be assumed that the building has 30 landings, with only the first, second and thirtieth landings being shown in order to simplify the drawing. The elevator car 12 is supported by ropes 16 which are reeved over a traction sheave 18 mounted on the shaft of a drive motor 20. The drive motor 20 is preferably a direct current motor, such as used in the Ward-Leonard Drive System, with the Ward-Leonard system utilizing either a motor-generator set, or solid-state components. A counterweight 22 is connected to the other ends of the ropes 16. A governor rope 24, which is connected to the elevator car 12, is reeved over a governor sheave 26 located above the highest point of travel of the car in the hatchway 13, and over a pulley 28 located at the bottom of the hatchway. A pickup 30 is disposed to detect movement of the elevator car 12 through the effect of circumferentially spaced openings 26a in the governor sheave 26. The openings in the governor sheave are spaced to provide a pulse for each standard increment of travel of the elevator car, such as

a pulse for each 0.5 inch of car travel. Pickup 30, which may be of any suitable type, such as optical or magnetic, provides pulses in response to the movement of the openings 26a in the governor sheave. Pickup 30 is connected to a pulse detector 32 which provides distance pulses DP for a floor selector 34, and for a speed pattern generator 48. Distance pulses DP may be developed in any other suitable manner, such as by a pickup disposed on the elevator car which operates with regularly spaced indicia in the hatchway.

Detailed Description Text (5):
The floor selector 34 processes the distance pulses DP from the pulse detector 32 to develop information concerning the position of the car 12 in the hatchway 13. The floor selector 34 keeps track of the elevator car 12, the calls for elevator service, it provides the "request to accelerate" signal ACC to the speed pattern generator 48, and it provides the "request to declerate" signal DEC for the speed pattern generator 48 at the precise time required for the elevator car to decelerate according to a predetermined floor for which a call for service has been registered. The floor selector additionally provides a signal NL 16 when the elevator car is 16 inches from the target floor. The floor selector 34 additionally provides signals for controlling such auxiliary devices as the door operator for the elevator car, the hall lanterns, and it also controls the resetting of the car call and corridor call controls when a car or corridor call has been serviced.

Detailed Description Text (6):
The speed pattern generator 48 generates a speed reference signal MPSP for an amplifier 49, which provides a speed pattern signal VSP for a controller 50. Controller 50 provides the drive voltage for motor 20.

Detailed Description Text (7):
The speed pattern generator 48 provides the speed pattern signal for controlling the drive motor 20 from the start of the run until the elevator car reaches a point 10 inches from the target floor. A precise car position speed pattern is then substituted for the speed pattern signal provided by the speed pattern generator 48, which brings the elevator car to floor level and maintains the car at floor level as the load in the elevator car changes.

Detailed Description Text (10):
The motor controller 50 includes a speed regulator responsive to the reference pattern provided by the speed pattern generator 48. The speed control is derived from a comparison of the actual speed of the motor and that called for by the reference pattern, such as by using a drag magnet regulator, such as disclosed in U.S. Pat. Nos. 2,874,806 and 3,207,265, or by using a servo control loop, such as disclosed in U.S. Pat. Nos. 4,030,570; 3,749,204; 3,713,012 and 3,713,011, all of which are assigned to the same assignee as the present application.

Detailed Description Text (11):
The present invention relates to a new and improved speed pattern generator which may be used for the speed pattern generator function 48. The new and improved speed pattern generator 48 may be constructed of hard-wired registers and logic circuits, or the new processing and logic functions may be performed by a microprocessor. If a microprocessor is used, the floor selector function 34 may also be performed by a suitable program in the same microprocessor, in which event the various signals developed by the floor selector for the speed pattern generator would be available at predetermined memory locations in the microprocessor. Since the floor selector function forms no part of the present invention, it will be assumed, for purposes of example, that the floor selector signals ACC, DEC and NL16 are produced in an external floor selector, such as the floor selector disclosed in U.S. Pat. No. 3,750,850, entitled "Floor Selector For An Elevator", which is assigned to the same assignee as the present application.

Detailed Description Text (12):

FIG. 2 is a detailed block diagram of a speed pattern generator 48 constructed according to the teachings of the invention, which may be used for the speed pattern generator 48 shown functionally in FIG. 1. FIGS. 3 and 4 are graphs which illustrate binary counts and pulse trains developed by the functions shown in FIG. 2, and these graphs will be referred to when describing the functions of FIG. 2.

Detailed Description Text (13):
In a digital speed pattern generator the pattern will be changed incrementally, and some rate must be chosen as the maximum rate at which a predetermined increment may be added to, or subtracted from, the speed pattern. Since one of the objects of the invention is to provide a new and improved digital speed pattern generator which may be implemented with microprocessor, the rate should be selected with this implementation in mind. For purposes of example, Intel's Microprocessor 8080A will be assumed, with an 18 MHz crystal supplying the clock after being counted down to 2 MHz. This signal is further counted down to 500 Hz to generate interrupts every two milliseconds, which are used for pattern generation. Thus, an iteration rate of 500 Hz will be assumed.

Detailed Description Text (14):
It will also be assumed that the digital velocity of speed pattern signal will be generated as a 16-bit value in a 16 bit velocity register V. If the motor controller 50 requires an analog signal, the 16 bit signal may be truncated to 12 bits before being applied to a digital to analog converter. The D/A converter would form the final output of the digital speed pattern generator. A 16 bit binary number has a full scale value of 65,535. If the 16-bit velocity register V is updated one count at a time, the 50 Hz iteration rate selected would be much too low, as it would take 1 second to advance the count to 500, and 131 seconds to advance the count to 65,535. Thus, to maintain the 500 Hz iteration rate selected, a value greater than 1 must be added to the velocity register V, each time the velocity register is updated.

Detailed Description Text (26):
Upon receiving a true signal ACC at the start of a run, speed pattern generator 48 enables an 8-bit acceleration or "a" counter 114 to count in the up direction, such as by a memory or flip-flop 116 which is set by signal ACC to a condition which enables counter 114 to count up. The counter 114 is enabled to count by an input signal at its "count enable" input from a comparator function 118. Comparator function 118 provides a signal which enables counter 114, at the start of a run, and the enable continues until some pre-set acceleration limit has been reached.

Detailed Description Text (37):
Instead of completely switching from a time dependent speed pattern to a distance dependent speed pattern when signal DEC goes true, such as disclosed in the hereinbefore mentioned U.S. Pat. No. 3,747,710, the present invention "slaves" the time dependent pattern to the distance dependent pattern. This arrangement has two major advantages. When control of an elevator drive motor is switched from one speed pattern signal to another speed pattern signal, it is important that the patterns match at the transfer point. A discontinuity in the patterns will be felt in the elevator car as a disagreeable bump. This transition may be smoothly made by single blending, such as disclosed in U.S. Pat. No. 3,651,892, which is assigned to the same assignee as the present application, using a comparator and analog switches. However, one of the objects of the present invention is to provide a speed pattern generator which is equally implementable by a microprocessor, as well as by hard-wired registers and logic. Signal blending is difficult to achieve in the microprocessor, and would probably require bringing the signals out of the microprocessor to signal blending hardware. The present invention assures a smooth transition from constant velocity to constant deceleration without the necessity of signal blending, and thus without requiring signal blending hardware. The second major advantage of the present invention is the fact that the time dependent signal is jerk controlled, and is also acceleration and velocity controlled. Thus,

regardless of how rapidly the distance based speed pattern changes, the time based speed pattern will follow the change within the built-in jerk constraint of the time based signal. In addition to limiting jerk during the slow-down phase, upper and lower limits on the magnitude of the deceleration are imposed on the time based signal, until the point is reached where the deceleration is to be reduced to stop the elevator car at a floor. A lower limit may also be placed on the velocity magnitude of the time based signal, to insure that the elevator car is approaching the 16 inch point at a predetermined minimum speed. Thus, various failure modes of the distance based speed pattern, which modes may result in a relatively large deviation from the desired pattern, will not be followed by the time based speed pattern.

Detailed Description Text (50):
While the new digital speed pattern generator has many advantages, regardless of whether its implementation is accomplished with registers and hard-wired logic or by a microprocessor, it is especially suitable for implementation by a dedicated digital computer, such as a microprocessor. FIG. 6 is a block diagram of a speed pattern generator 48' which illustrates a microprocessor implementation of the invention. FIGS. 7 and 8 illustrate flow charts which may be used by a programmer of average skill to program the microprocessor to perform the functional aspects of the invention hereinbefore set forth. More specifically, speed pattern generator 48' includes a microprocessor 200, which will be assumed to be Intel's 8080, but any suitable microprocessor or digital computer may be used. Microprocessor 200 includes an input port 202 (Intel's 8212), a system controller 204 (Intel's 8228), a central processor or CPU 206 (Intel's 8080A), a clock generator 208 (Intel's 8224), a read-only-memory 210, also referred to as ROM 210 (Intel's 8708), a random access memory 212, also referred to as RAM 212 (Intel's 8102A-4), a priority interrupt 214 (Intel's 8214), and an output port 216 (Intel's 8212).

Detailed Description Text (51):
In this embodiment of the invention, an external floor selector 34 provides the signals ACC, DEC and NL16, but they could also be generated in a floor selector program stored in ROM 210. The external signals ACC, DEC, NL16 and LAZO are periodically read from the input port 8212 and stored in RAM 212. The two millisecond clock 104 and the distance pulse generator 32 are each connected to provide inputs for the priority interrupt 214. The two millisecond clock provides the timing for the iteration rate of the speed pattern generator. The distance pulses DP are counted until signal DEC is set, or V.sub.max is reached, whichever occurs first, and this count is counted down when signal DEC is set. This distance-to-go count is repetitively operated upon to provide a square root count, during the deceleration portion of the speed pattern. ROM 210 contains the program for performing the functions of the new and improved speed pattern generator 48'.

CLAIMS:

1. A speed pattern generator for providing a speed pattern signal which is changeable between zero and a predetermined maximum value within predetermined jerk and acceleration constraints, comprising:

acceleration means and velocity means each selectively incrementable and decrementable by first and second predetermined binary increments, respectively,

jerk means providing a first pulse train at a predetermined constant average rate for said acceleration means, with said rate being indicative of the maximum rate at which said acceleration means should be changed by the selected first binary increment,

first control means enabling said acceleration means to be incremented, and subsequently decremented, in response to said first pulse train, when it is desired to increase the speed pattern signal from zero to a predetermined magnitude,

digital integrating means providing a second pulse train, said second pulse train having a controllable rate, with said rate being responsive to the binary count on said acceleration means, said rate being indicative of the rate at which said velocity means should be changed by the selected second binary increment,

and second control means enabling said velocity means to be incremented in response to said second pulse train, to increase the binary count on said velocity means from zero to a predetermined value.

2. The speed pattern generator of claim 1 wherein the first control means enables the acceleration means to be incremented, and subsequently decremented, in response to the first pulse train, when it is desired to reduce the speed pattern signal towards zero, and the second control means enables the velocity means to be decremented in response to the second pulse train to reduce the binary count on the velocity means towards zero.

3. The speed pattern generator of claim 1 wherein the binary count on the velocity means provides a first digital speed pattern signal, and including means providing a second digital speed pattern signal in response to a predetermined parameter, and wherein the first control means slaves the first digital speed pattern signal to the second digital speed pattern signal by enabling the first pulse train to increment and decrement the acceleration means in response to the first digital speed pattern signal being less than, and greater than, the second digital speed pattern signal, respectively.

4. The speed pattern generator of claim 1 wherein the jerk means includes counting means which resets and provides a carry signal each time its capacity is exceeded, and clock means, said counting means being incremented by a third predetermined binary increment in response to said clock means, with the carry signals providing the first pulse train.

5. The speed pattern generator of claims 1 or 4 wherein the digital integrating means includes counting means which provides a carry each time its capacity is exceeded, said counting means repetitively adding the binary count of the acceleration means to its count at a predetermined rate, with the carry signals providing the second pulse train.

6. The speed pattern generator of claim 1 wherein the first binary increment is equivalent to 1, and the second binary increment is equivalent to a number which exceeds 1.

7. The speed pattern generator of claim 4 wherein the first binary increment is equivalent to 1, and the second and third binary increments are each equivalent to numbers which exceed 1.

8. The speed pattern generator of claim 4 wherein the digital integrating means includes counting means which adds the binary count of the acceleration means to its count in response to the clock means.

9. A speed pattern generator for providing a speed pattern signal which is changeable between zero and a predetermined maximum value within predetermined jerk and acceleration constraints comprising:

acceleration means selectively incrementable and decrementable by a first predetermined binary increment,

jerk means providing a first pulse train at a predetermined constant average rate, with said rate being indicative of the maximum rate at which said acceleration means should be changed when using said first binary increment,

first control means enabling said acceleration means to be incremented by said first binary increment in response to the pulses of said first pulse train, when the speed pattern signal is to be provided, until the acceleration means reaches a predetermined binary count indicative of a predetermined acceleration,

velocity means selectively incrementable and decrementable by a second predetermined binary increment,

digital integrating means providing a second pulse train, said second pulse train having a controllable rate responsive to the count on said acceleration means, with the rate of said second pulse train being indicative of the rate at which said velocity means should be changed when using said second binary increment,

and second control means enabling said velocity means to be incremented by said second binary increment in response to said second digital pulse train, until the velocity means reaches a predetermined value,

said first control means being responsive to said velocity means, enabling said acceleration means to be decremented towards zero by the first binary increment in response to said first digital pulse train, when the velocity means reaches a predetermined binary count, to reduce the rate of change of the count on said velocity means as the predetermined value is approached.

10. The speed pattern generator of claim 9 wherein the jerk means includes counting means which provides a carry signal each time its capacity is exceeded, and clock means, said counting means being incremented by a third predetermined binary increment in response to said clock means, with the carry signals providing the first pulse train.

11. The speed pattern generator of claims 9 or 10 wherein the digital integrating means includes counting means which resets and provides a carry each time its capacity is exceeded, said counting means repetitively adding the binary count on the acceleration means to its count at a predetermined rate, with the carry signals providing the second pulse train.

12. The speed pattern generator of claim 9 wherein the first binary increment is equivalent to 1, and the second binary increment is equivalent to a number which exceeds 1.

13. The speed pattern generator of claim 10 wherein the first binary increment is equivalent to 1, and the second and third binary increments are each equivalent to numbers which exceed 1.

14. The speed pattern generator of claim 10 wherein the digital integrating means includes counting means which adds the binary count of the acceleration means to its count in response to the clock means.

15. The speed pattern generator of claim 9 wherein the first control means, in response to a predetermined parameter when the velocity means has a count greater than zero, and the acceleration means has a count equal to zero, enables the acceleration means to be incremented to a predetermined binary count, and subsequently decremented, in response to the first pulse train, the digital integrating means provides the second pulse train in response to the binary count on the acceleration means, and wherein the second control means, in response to the predetermined parameter, enables the velocity means to be decremented towards zero by the second binary increment in response to the second pulse train.

16. The speed pattern generator of claim 15 wherein the binary count of the velocity means provides a first digital speed pattern signal, and including means

providing a second digital speed pattern signal in response to a predetermined parameter, and wherein the first control means slaves the first digital speed pattern signal to the second digital speed pattern signal when the velocity means is being decremented, by enabling the first pulse train to increment and decrement the acceleration means, in response to the first digital speed pattern signal being less than, and greater than, the second digital speed pattern signal, respectively.

17. A speed pattern generator for directing the movement of an elevator car from one floor of a building to another floor, comprising:

means providing a first digital speed pattern signal which changes within predetermined maximum jerk and acceleration constraints,

means providing a second digital speed pattern signal responsive to the slow-down distance from the elevator car to a floor at which it is to stop,

and means slaving the first digital speed pattern signal to the second digital speed pattern signal,

with said first digital speed pattern signal being used to direct the movement of said elevator car.

18. The speed pattern generator of claim 17 wherein the slaving means only slaves the first digital speed pattern signal to the second digital speed pattern signal during a deceleration phase of the run, while the first digital speed pattern signal controls the movement of the elevator car without slaving during other portions of the run.

19. A speed pattern generator for directing the movement of an elevator car from one floor of a building to another floor, within predetermined maximum jerk and acceleration constraints, comprising:

first means providing a first digital speed pattern signal for decelerating the elevator car,

said first means including jerk means which provides a first pulse train at a predetermined constant average rate, acceleration means which has a binary count which is selectively incrementable and decrementable by said first pulse train, digital integrating means which provides a second pulse train at a rate proportional to the binary count on said acceleration means, and velocity means which has a binary count which is decrementable by said second pulse train,

second means providing a second digital speed pattern signal responsive to the distance to go from the elevator car to the floor at which it is to stop,

and control means responsive to the difference between said first and second digital speed pattern signals for incrementing said acceleration means responsive to said first pulse train when the count of said first digital speed pattern signal is less than the count of said second digital speed pattern signal, and for decrementing said acceleration means responsive to said first pulse train when the count of said first digital speed pattern signal is greater than the count of said second digital speed pattern signal.

20. The speed pattern generator of claim 19 wherein the first means provides the first digital speed pattern signal for the acceleration and constant velocity portions of the run of the elevator car, with the second means slaving the first digital speed pattern signal to the second digital speed pattern signal only during a deceleration portion of the run.

21. The speed pattern generator of claim 19 including means responsive to the first digital speed pattern signal for providing a first analog speed pattern signal, hatch transducer means providing a second analog speed pattern signal, the second analog speed pattern signal of said hatch transducer means being slaved to follow the first analog speed pattern signal as the elevator car approaches the floor at which it is to stop, and means switching from the first analog speed pattern signal to the second analog speed pattern signal at a predetermined location of the elevator car relative to the floor at which it is to stop.

22. The speed pattern generator of claim 19 wherein the second means slaves the first digital speed pattern signal to the second digital speed pattern signal, only after the first speed pattern signal is changed to a constant deceleration portion of the speed pattern.

23. The speed pattern generator of claim 19 including means providing upper and lower acceleration limits for the first speed pattern signal while being slaved to the second speed pattern signal, which limit the count range of the first digital speed pattern signal, regardless of the count on the second digital speed pattern signal.

First Hit

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L10: Entry 30 of 37 File: JPAB Mar 24, 1982

DOCUMENT-IDENTIFIER: JP 57050023 A
TITLE: SPEED COMMANDING CIRCUIT OF POSITIONING SERVO DRIVE DEVICE

Abstract Text (1):
PURPOSE: To improve positioning precision with simple constitution by obtaining a speed command variable by a speed pattern generating circuit relating to an acceleration-deceleration run distance based upon a stop point.

Abstract Text (2):
CONSTITUTION: In an up/down counter 6, an acceleration-deceleration run distance Sv from a stop position is held and used as the address signal of a speed pattern generator 7. In the memory MEM of the pattern generator 7, values for which an equation (where k is a constant and α is acceleration) holds are stored for constant acceleration-deceleration control, thereby obtaining a speed command pulse string OUT' which corresponds to the acceleration-deceleration run distance Sv. Under the control of a control means 3', the pulse OUT' is applied to the up or down terminal of the up/down counter 6 through a frequency divider 8 to vary the acceleration-deceleration run distance Sv. The application of the pulse string to the counter terminal is performed only during acceleration or deceleration.

First Hit

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L10: Entry 31 of 37 File: JPAB Mar 1, 1982

DOCUMENT-IDENTIFIER: JP 57037267 A
TITLE: SPEED PATTERN GENERATOR

Abstract Text (1):
PURPOSE: To prevent the quick change in the armature current of a servomotor by continuously decreasing the speed pattern at the vicinity where acceleration is changed to deceleration in time sequence, and obtaining a step shaped pattern in a low deceleration region.

Abstract Text (2):
CONSTITUTION: An analog multiplexer is constituted by an analog switch group 11 and a decoder circuit 12 wherein one switch in said switch group 11 is selected and conducted based on an inputted digital signal. An impedance Z7 which is selected by a switch S7 is formed by resistors R7a and R7b and a capacitor C7. An impedance Z6 selected by a switch S6 is formed by resistors R6a and R6b and a capacitor C6 like the impedance Z7. Impedances Z8 and Z5~Z1 are formed only by resistors. In this constitution, occurrence of vibration can be prevented in a transient period without degrading the response of the servomotor.